Laboratory of Metabolomics

Leader: Dr Łukasz Stępień

Staff:

prof. Jerzy Chełkowski
Assoc. prof. Piotr Kachlicki
dr Lidia Błaszczyk
dr Delfina Popiel
Magdalena Biegańska, M.Sc.
Anna Piasecka, M.Sc.
Karolina Wilman, M.Sc.
Barbara Kalemba

PhD students:

Judyta Strakowska, M. Sc.
Mariusz Czyżniejewski, M. Sc.

Research topics:

– Interactions between *Fusarium* pathogens and cereal plants, both at vegetative and generative stage (seedlings, ears, kernels), as well as the influence of *Fusarium* metabolites on host plants,
– Identification of *Fusarium* species and chemotypes by molecular markers,
– Identification of resistance genes to leaf rust in wheat using PCR and validation of *Lr* gene markers,
– Mechanisms of the ability of *Trichoderma* and *Clonostachys* fungi to reduce the growth and mycotoxin production by *Fusarium* pathogens, molecular characterization of antagonistic fungi,
– Mycotoxin biosynthec pathways – gene evolution and polymorphism in various *Fusarium* species,
– Role of secondary metabolites in the interaction between host-plant and fungal pathogens,
– Role of secondary metabolites in plant defense against abiotic stress conditions (acclimatization to drought and cold),
– Development of new methods of analysis of plant and fungal metabolites with use of high performance liquid chromatography (HPLC and UPLC) hyphenated with mass spectrometry.
– Profiling of secondary metabolites in plant tissues.

Major achievements:

– Development of a method for qualitative and quantitative assessment of the composition of individual prolamin protein classes in wheat kernels, facilitating the estimation of flour properties using high-performance capillary electrophoresis and rheological methods.
– Development of multiple PCR reaction to identify Glu-1 genes in wheat (*Triticum aestivum* L.) for the purpose of a prompt evaluation of genotypes with desirable technological traits.
– Clarification of quantitatively inherited resistance of triticale and barley to ear blight and seedling blight caused by *Fusarium culmorum* and *F. avenaceum*, including mycotoxins accumulation (deoxynivalenol and nivalenol) in kernels.
– Determination of toxin-formation ability of *Fusarium* pathogens infecting ears of corn (primarily *F. subglutinans, F. poae, F. proliferatum* and *F. graminearum*) and susceptibility of Polish maize hybrid varieties to infestation with these pathogens.
– Verification of the STS-PCR type DNA markers to identify resistance genes for brown rust of wheat (also by means of a interlaboratory ring test).
– Development of methods of analysis of various groups of plant and fungal secondary metabolites with use of HPLC/MS technique, in particular – flavone and isoflavone glycosides and glucuronates.
– Application of HPLC/MS to analysis of plant fitochelatins and identification of their oxidized and reduced forms present in variable amounts in different plant organs.
– Detection of changes in plant metabolomes in response to fungal infection and their differences that depend on physiological state of leaves of treated plants and way of infection.